CLAIMS:

1. A method for the spatially resolved determination of physical, chemical and/or biological properties or state variables, particularly substance concentrations, temperature, pH and/or physical fields, and/or the change in such physical, chemical and/or biological properties or state variables in an examination area of an examination object by determining the change in the spatial distribution and/or the mobility, particularly the mobility in rotation, of magnetic particles in this examination area or in parts thereof as a function of the effect of physical, chemical and/or biological influencing variables on at least a part-area and/or in the physical, chemical and/or biological conditions in at least a part-area of the examination area, by means of the following steps:

a) introducing at least partially covered and/or coated magnetic particles having at least one solid, viscous and/or liquid shell or coating and into at least part of the examination area and/or introducing magnetic particles into at least part of the examination area and covering and/or coating at least some of these particles in the examination area,

b) generating a magnetic field with a spatial profile of the magnetic field strength such that there is produced in the examination area a first part-area having a low magnetic field strength and a second part-area having a higher magnetic field strength,

c) changing the, in particular relative, spatial position of the two part-areas in the examination area or changing the magnetic field strength in the first part-area so that the magnetization of the particles is locally changed,

d) detecting signals that depend on the magnetization in the examination area that is influenced by this change, and

e) evaluating the signals so as to obtain information about the change in the spatial distribution and/or mobility of the magnetic particles in the examination area.

2. A method as claimed in claim 1, characterized in that step b) takes place before step a) or in that steps a) and b) are carried out essentially at the same time and/or in that steps c) to e) are repeated at least once.

3. A method as claimed in claim 1 or 2, characterized in that the examination object is a polymer material, in particular a thermoplastic polymer or a polymer blend, a polymer melt, a microorganism, a plant, a plant part, a living thing or a part of a living thing.

4. A method as claimed in any of the preceding claims, characterized in that the degree of mobility of the magnetic particles in the examination area is determined continuously or at intervals and is correlated with a state variable or property of the examination area, in particular a temperature, a concentration and/or a viscosity.

5. A method as claimed in any of the preceding claims, characterized in that the degree of mobility of the magnetic particles in a polymer melt that is forming or curing is determined continuously or at intervals and is correlated with the degree of curing or the degree of melting of a polymer material, in particular of a thermoplastic polymer.

6. A method as claimed in any of the preceding claims, characterized in that at least some of the magnetic particles have anisotropic properties.

7. A method as claimed in any of the preceding claims, characterized in that the effective anisotropy of the magnetic particles is great enough for the reversal of the magnetization of the particle to take place by means of geometric (Brown's) rotation and by means of Neel's rotation.

8. A method as claimed in any of the preceding claims, characterized in that the magnetic particle is a monodomain particle the magnetization of which is reversed by means of Brown's rotation and Neel's rotation.

9. A method as claimed in any of the preceding claims, characterized in that the magnetic particle is a hard- or soft-magnetic multidomain particle.

10. A method as claimed in any of the preceding claims, characterized in that the magnetic particles comprise hard-magnetic materials.

11. A method as claimed in any of the preceding claims, characterized in that the hard-magnetic materials comprise Al-Ni, Al-Ni-Co and Fe-Co-V alloys and also barium ferrite (BaO $6xFe_2O_3$).

12. A method as claimed in any of the preceding claims, characterized in that the material for the covering or coating can be degraded or dissolved thermally, chemically, biochemically, by means of electromagnetic radiation or ultrasound and/or mechanically.

13. A method as claimed in any of the preceding claims, characterized in that the material for the covering or coating comprises polysaccharides, starch, in particular dextrins or cyclodextrins, waxes, oils, fats, glycerin, gels or plastics, in particular thermoplastic polymers or blends thereof.

14. A method as claimed in any of the preceding claims, characterized in that at least some of the magnetic particles have a coating or covering consisting of at least one protein, polypeptide, antibody and/or organosilane.

15. A method as claimed in any of the preceding claims, characterized in that the evaluation takes place by means of the following steps:

a) selection of a path for the movement of the first part-area having a low magnetic field strength within the examination area,

b) recording of reference data by means of reference samples along the path according to a) at at least one location, in particular a number of locations, in the case of at least two, in particular a number of, external parameters using at least a first receiving coil,

c) interpolation and/or extrapolation of the reference data recorded in b) in respect of points and external parameters not recorded in step b),

d) measurement of the path within the examination area in a sequence that is identical to that used for the recording of data by means of reference samples according to b) via at least a first and/or second receiving coil, and

e) comparison of the data obtained according to d) with the reference data according to b) and/or c), in particular by minimizing the error square.

16. A method as claimed in claim 15, characterized in that in a step c') that follows step c), the reference data obtained in steps b) and/or c) are converted to the characteristics of at least a second receiving coil used for the measurement in step d).

17. A method as claimed in claim 15 or 16, characterized in that in a further step f) the data obtained by means of comparison in step e) are assigned to a gray value for a pixel to give an image, with the relative pixel intensity representing the degree of the determined external parameters.

18. A method as claimed in claim 17, characterized in that in a further step g) the images obtained in step f) are displayed in a merged image.

19. A method as claimed in any of claims 15 to 18, characterized in that the sequence of steps d) and e) is repeated at least once.

20. Functionalised magnetic particle composition for imaging physico-chemical parameters in the examination area with a magnetic particle imaging techniques, comprising magnetic particles coated with a functional coating material that changes physico-chemical properties when exposed to conditions prevailing in the examination area such that the mobility and/or rotational freedom of the magnetic particles in the examination area changes in a way and/or to an extent depending on the physico-chemical conditions.

21. Functionalised magnetic particle composition according to claim 20 , wherein the magnetic particles are mono-domain particles having have an anisotropy, the magnetisation of which is reversed at least in part by geometric rotation.

22. Functionalised magnetic particle composition according to claim 21, wherein the magnetic particles are monodomain particles having have an internal anisotropy field of at least 0.1 mT, preferably at least 0.5mT and/or wherein the composition has an opening in the hysteresis loop in the magnetisation curve of at least 0.1 mT, preferably at least 0.5mT conditions.

23. Functionalised magnetic particle composition according to claims 20 to 22, for the imaging of the temperature in the examination area, wherein the functional coating

material has a viscosity that is dependent on the temperature within a temperature range of interest in the examination area.

24. Functionalised magnetic particle composition according to claims 20 to 22 , for the imaging of temperature in the examination area, wherein the functional coating is a material having a melting temperature in a temperature window of interest in the examination area.

25. Functionalised magnetic particle composition according to claim 24, for the imaging of temperature in the examination area, wherein the particle composition comprises a mixture of at least two different parts having a different functional coating with a different melting temperature.

26. Functionalised magnetic particle composition according to claim 24 to 25, wherein the examination area is a living organism and the melting temperature of the functional coating material is between 30 and 50°C.

27. Functionalised magnetic particle composition according to claim 20 to 22 , for the imaging of pH in the examination area, wherein the functional coating comprises a hydrolysable coating material, for example an amino acid, that hydrolyses in an aqueous medium at a rate dependent on the pH of the aqueous medium.

28. Functionalised magnetic particle composition according to claim 20 to 22 , wherein the magnetic particles are coated with a material comprising a functional group reactive to a specific target molecule in the examination area wherein the magnetic particles after binding to the target molecule have a reduced rotation mobility, such as to produce contrasts in the magnetic particle image between the area as that do and do not contain the specified target molecule.

29. Functionalised magnetic particle composition according to claim 28 , wherein the functional group is a specific amino acid and the target molecule is an enzyme.

30. Functionalised magnetic particle composition according to claim 28 , wherein the functional group is a DNA or RNA strand or sequence complementary and/or capable of binding with a target DNA or RNA.

31. Functionalised magnetic particle composition according to claim 28, wherein the target molecule is an antibody.

32. Functionalised magnetic particle composition according to claims 20 to 23 for the examination of enzyme activity in the examination area, wherein the magnetic particles are coated with a material, in particular a protein, that is enzymatically decomposed by the target enzyme.

33. Magnetic particle composition having a magnetization curve having a step change, the step change being characterized in that the magnetization change, as measured in an aqueous suspension, in a first field strength window of magnitude delta around the inflection point of said step change is at least a factor 3 higher than the magnetization change in the field strength windows of magnitude delta below or in the field strength windows of magnitude delta above the first field strength window, wherein delta is less than 2000 microtesla and wherein the time in which the magnetisation step change is completed in the first delta window is less than 0.01 seconds.

34 . Functionalised magnetic particle composition according to claims 20 to 33 the magnetic particles are a magnetic particle composition according to claim 33.

35. An aparatus to determine the spatially resolved determination of physical, chemical and/or biological properties or state variables and/or the change in physical, chemical and/or biological properties or state variables in an examination area of an examination object comprising:

a) means to generate a magnetic field with a spatial distribution of the magnetic field strength such that the area of examination consists of a first sub-area with lower magnetic field strength and a second sub-area with a higher magnetic field strength,

b) means to change the spatial location of both sub-areas in the area of examination so that the magnetization of the particles changes locally,

c) means for the acquisition of signals that depend on the magnetization in the area of examination influenced by this change,

d) means for the evaluation of said signals to obtain information about the spatial distribution of the signals in the area of examination and

e) means to perform calibration measurements as in method claims 15 to 19, comprising means to record reference data on reference samples and means to compare the signals obtained in step c and/or d with the reference data to evaluate spatially resolved information about in situ, physical, chemical and/or biological properties or state variables in the area of examination.